REMARKS/ARGUMENTS

The present invention relates to a composite display device (**11**) that allows an observer (**14**) to view simultaneously a background scenery (**15**) and a display effected by an electro-optical element (**2**) in a used state. Non-limiting examples of the composite display device (**11**) are shown below, reproduced from Figures 1 and 5 of the specification.

Figure 1

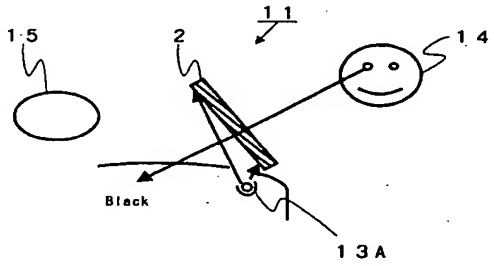
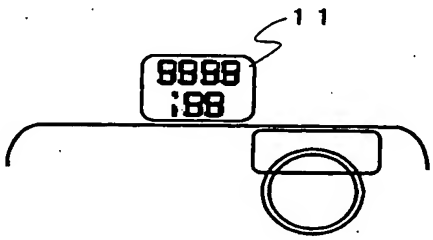
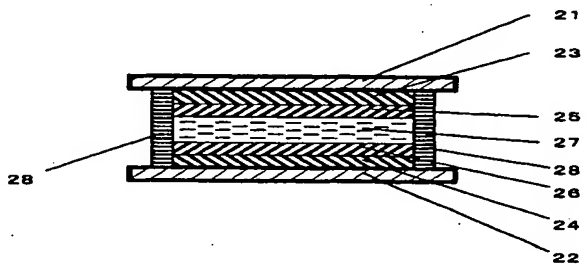


Figure 5



For instance, the composite display device (**11**) comprises a first display member and a second display member disposed between the first display member and an observation point, in which the second display member comprises an electro-optical element (**2**). A non-limiting example of the electro-optical element (**2**), reproduced from Figure 2 of the specification, is shown below.

Figure 2



The electro-optical element (**2**) comprises a pair of substrates (**21, 22**) with transparent electrodes (**23, 24**) and a composite layer (**27**) interposed therebetween, in which the composite layer comprises a liquid crystal/cured resin composite comprising liquid crystal

and a cured product of a specific curable compound of Formula 1 and/or Formula 2, as recited in claim 1, soluble to the liquid crystal.

In automobiles, for example, it is desirable that a display device is transparent so that an observer can simultaneously obtain information from the display and observe in the background of the display road conditions and the general environment outside the automobile. An example of a conventional display device for an automobile includes a headup display (HUD) for projecting information in a driver's forward sight, in which an image is formed by projecting light from a display unit on a translucent reflective plane such as a half mirror or a hologram at a windshield glass so that an observer can see the display. Use of the half mirror or the hologram, however, has drawbacks that include a narrow viewing angle, background scenery that is colored, and transparency that is damaged. Other types of display devices can have similar problems.

The present inventors have found that that the display device of the present invention greatly diminishes the drawbacks associated with other display devices, since the composite display device efficiently provides a display in a background scenery in an "ON-period" and minimizes the presence of it in an "OFF-period." In particular, the composite display device transmits light under application of no voltage and scatters light under application of a voltage, in which the light transmittance under application of no voltage is at least 80%. Such a composite display device is not disclosed or suggested by the cited prior art references of record.

Claims 1, 8, and 12-15 are rejected under 35 U.S.C. 103(a) over Asakawa et al. (U.S. Patent No. 5,892,598) in view of Date et al. (U.S. Patent No. 6,618,104); claims 3, 4, 9, and 10 are rejected further in view of Kobayashi et al. (U.S. Patent No. 6,261,650); claim 2 is rejection further in view of Hirai et al. (U.S. Patent No. 5,103,327); claims 7 and 11 are

rejected further in view of Nishiyama et al. (U.S. Patent No. 6,507,385); and claims 5 and 6 are rejected further in view of Sullivan (U.S. Patent No. 6,100,862).

Applicants respectfully traverse these rejections, since the prior art cited references do not describe or suggest a composite display device comprising an electro-optical element having a composite layer that specifically includes **a)** a curable compound of Formula (1) and/or Formula (2), and/or **b)** a light transmittance under application of no voltage is at least 80% as recited in the claimed invention.

Asakawa et al. generally describes a head up display device (HUD) for a vehicle, in which "a substantially transparent display, an optical system, and an illumination system are united in a body and which is compact" (column 3, lines 1-4). The head up display unit comprises, *inter alia*, a "transparent and flat image information display" by means of "a liquid crystal display, particularly a polymer dispersed liquid crystal panel" (column 3, lines 17-19). "The liquid crystal display comprises: two substrates having electrode layers, at least one of said substrates being transparent; and a light regulating layer composed essentially of a liquid crystal phase and a high polymer phase, interposed between the substrates" (column 4, lines 9-13). "The entire device can easily be made transparent" "when a voltage is applied and a refractive index of [the] liquid crystal phase in is varied" (column 4, lines 26-29). However, there is no description of the polymer dispersed liquid crystal including a compound of the claimed Formula (1) or Formula (2), or the specific light transmittance of at least 80% under application of no voltage.

As shown in several embodiments in column 20 (e.g., Embodiments C-1; C-2; C-3; and C-4) of the reference, the liquid crystal composite contains a mixture of liquid crystal and various polymeric components. However, the reference only indicates that a high level of transmittance is exhibited when voltage is applied. For instance, the liquid crystal composites exhibit a "transmittance of about 77% with a threshold voltage of about 77%", a

"transmittance was 85% with a threshold voltage of 28 V", a "transmittance was 85% with a threshold voltage of 30 V", and a "transmittance was 87% with a threshold voltage of 40 V" (column 20, lines 39-67). There is no evidence that a transmittance of 77% or more is provided when no voltage applied, or that the liquid crystal composite even contains a compound of the claimed invention.

In contrast, the present invention specifically provides for a composite display device in which a "light transmitting state can be provided when the electro-optical element 2 does not display, e.g., when the power source is in an OFF state. Then, an observer can see a background side of the electro-optical element 2 . . . [in which] the light transmittance is determined to be at least 80%" (specification at page 14, line 25 – page 15, line 5). The composite layer of the electro-optical element is constructed such that a composition comprising liquid crystal and a curable compound soluble to the liquid crystal is sandwiched "between a pair of substrates with transparent electrodes and by curing the curable compound by heat, ultraviolet rays or electron beams" (specification at page 20, lines 14-19). "As the curable compound to produce a cured product having such structure, a curable compound soluble to liquid crystal should be selected. Then, it is possible to control the aligning of an uncured mixture, and a high transparency is obtainable in curing of the cured product" (specification at page 21, lines 3-8). The compound is specifically represented by Formula (1) or a compound represented by Formula (2), as follows:

A^1-O-$(R^1)_m$-O-Z-O-$(R^2)_n$O-A^2 Formula (1)

A^3-$(OR^3)_o$-O-Z'-O-$(R^4O)_p$-A^4 Formula (2)

in which each of A^1, A^2, A^3 and A^4 which are independent of one another, is an acryloyl group, a methacryloyl group, a glycidyl group or an allyl group; each of R^1, R^2, R^3 and R^4 which are independent of one another, is an alkylene group having a carbon number of from 2 to 6; each of Z and Z' which are independent of each other, is a bivalent mesogen structural portion, and each of m, n, o and p which are independent of one

another, is an integer of from 1 to 10 (specification at page 21, lines 9-22).

In addition, "[i]n the thus prepared composite display device, the response speed of display pixels between a transmitting state and a scattering state can be very fast as 3 ms or less," and "the viewing angle dependence is good and a very excellent transmitting state can be obtained even in view from an oblique direction, in comparison with scattering/transmitting modes by the conventional liquid crystal" (specification at page 26, lines 3-6). For instance, "when a composite comprising liquid crystal and a curable compound having a composition described [above] is used, it is possible to eliminate substantially haze even when the composite display device is observed from a direction inclining 40° from [a] vertical direction" (specification at page 26, lines 7-16). As such a composite display is not described in Asakawa et al., the claimed invention is not obvious in view of the reference.

The secondary references do not cure the deficiencies of Asakawa et al.

Date et al. describes "an optical device for electrically controlling [the] retrieval of light in a light guide" that includes an optical control containing a liquid crystal layer, transparent electrodes, and a reflection plate having "a reflection film such as aluminum" (column 1, lines 13-15; column 12, lines 49-52). The liquid crystal may include "a reverse mode polymer dispersed liquid crystal" (PDLC), in which the liquid crystal has a uniform transmission state when an electric field is not applied (column 14, lines 60-66). However, there is no description of a composite layer that contains the compound of the claimed invention, and there is no indication that uniform transmission indicates light transmittance under application of no voltage that is at least 80%.

Kobayashi et al. generally describe a PDLC display element for employment with an electronic apparatus, that "is fabricated by mixing together a polymer or polymer precursor and a liquid material, placing the resulting mixed solution in its liquid crystalline state

between a pair of spaced electrodes to produce a PDLC display element" (column 4, lines 38-43). A "dichroic dye is added to the liquid crystal to provide for transmitted light absorption . . . in the range of about 1% to 20% in the absence of an applied electric field" (column 4, lines 45-47). The dichroic dye is added specifically to reduce "the turbidity of the display in the absence of an applied field" (column 8, lines 24-26). In addition, the reference lists several different monomers that may used as polymer precursors, as shown in at column 6, line 57 - column 7, line 39, and column 12, line 55 - column 13 line 30. However, there is no evidence that one would selectively choose among these monomers to modify Asakawa et al. to arrive at the claimed invention.

Even assuming, *arguendo*, that one would pick and choose a select monomer from the eight formulas and several substituents recited in the reference, there would be no motivation to do so. In particular, the reference explicitly discloses in each of Examples 1-28, monomers used in the display device that do not include compounds specifically recited by Formula (1) or Formula (2) of the claimed invention.

Hirai et al. generally describes "an active matrix liquid crystal display element having an active element for each picture element electrode and a projection type active matrix liquid display apparatus" (column 1, lines 7-10). In particular, the display comprises, *inter alia*, a liquid crystal composite material in which a nematic liquid crystal having a positive dielectric anisotropy is dispersed and held in a polymer matrix" (column 2, lines 15-18). However, the polymer matrix does not contain a compound of Formula (1) or (2) of the claimed invention, and there is no evidence whatsoever that the display has a light transmittance under application of no voltage that is at least 80%.

Sullivan generally describes a multi-planar volumetric display, which includes a plurality of optical elements (column 2, lines 56-60). "Each of the plurality of individual optical elements of the multi-surface optical device includes a liquid crystal element having a

controllable variable translucency" (column 3, lines 2-5). However, the liquid crystal elements are only described as being composed of "nematic, ferroelectric, ore cholesteric materials, or other polymer stabilized materials" (column 6, lines 17-19). There is no evidence or suggestion of electro-optical element containing a composite layer of the claimed invention, or any indication of a specific light transmittance without application of voltage.

Thus, as the combined references do not describe or suggest a composite display device having the required limitations of the electro-optical element as recited in the claimed invention, the claimed invention is unobvious.

Thus, in view of the foregoing reasons, Applicants respectfully request the withdrawal of the rejection under 35 U.S.C. § 103(a).

The rejection of claim 8 under 35 U.S.C § 112, second paragraph is obviated by amendment. The claim more clearly recites "a portion of the electro-optical element, excluding a connecting portion to an external circuit formed in a peripheral portion of the electro-optical element, is transparent."

Applicants submit that the application is now in condition for allowance. Early notification of such allowance is earnestly solicited.

Respectfully submitted,

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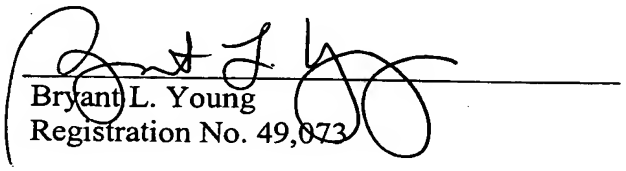

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